

AMENDMENTS TO THE CLAIMS

Claims 1-48. (canceled)

Claim 49. (new) A receiving apparatus for receiving signals in a digital telecommunication system, comprising:

receiving means for receiving a reference symbol comprising a plurality of repetition patterns, whereby each repetition pattern comprises a number of samples, the number of samples being the same in each repetition pattern, and whereby the last repetition pattern is phase-shifted in relation to the other repetition patterns, and

synchronizing means for synchronizing the receiving apparatus in the digital telecommunication system using said received reference symbol, whereby said synchronizing means comprises a correlation means for cross correlating the plurality of repetition patterns within a correlation window having a predetermined length, and whereby the phase-shift information of said last repetition pattern in relation to the other repetition patterns in said reference symbol is used in said synchronizing means to detect a correlation peak which indicates the position of the said last repetition pattern.

Claim 50. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 49, wherein said phase-shifted repetition pattern is phase-shifted by 180° in relation to said other repetition patterns.

Claim 51. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 49, wherein said correlation means has a

correlation window length corresponding to the length of one repetition pattern, whereby an output signal of said correlation means is supplied to a detection means for detecting the correlation peak.

Claim 52. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 51, wherein said detection means comprises a delay means for delaying the output signal of said correlation means by one repetition pattern length and a subtraction means for subtracting the output signal of said delay means from the output signal of said correlation means.

Claim 53. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 52, further comprising averaging means for smoothing the output signal of said detection means.

Claim 54. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 49, wherein said correlation means has a correlation window length corresponding to the length of two repetition patterns for detecting the position of the correlation peak.

Claim 55. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 54, wherein said correlation means uses a positive and a negative conjugation of an expected repetition for detecting the position of said correlation peak.

Claim 56. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 49, wherein the output signal of said detection means is supplied to peak threshold detection means and gap detection means, whereby said correlation peak detected by said detection means is confirmed or not on the basis of detection results of said peak threshold detection means and said gap detection means.

Claim 57. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 56, wherein said peak threshold detection means detects if the output signal of the detection means exceeds a predetermined correlation peak threshold, and the gap detection means detects if the output signal of said detection means has been below a predetermined gap threshold before said detected correlation peak.

Claim 58. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 57, further comprising delay means for delaying the output signal of said detection means before being supplied to said gap detection means.

Claim 59. (new) The receiving apparatus for receiving signals in a digital telecommunication system according to claim 57, wherein said gap detection means detects if the output signal of said detection means has been below said predetermined gap threshold during a predetermined gap time.

Claim 60. (new) A method for synchronizing a receiving apparatus in a digital telecommunication system, comprising the steps of:

receiving a reference symbol comprising a plurality of successive repetition patterns, whereby each repetition pattern comprises a number of samples, the number of samples being the same in each repetition pattern, and whereby the last repetition pattern is phase-shifted in relation to the other repetition patterns, and

synchronizing the receiving apparatus in the digital telecommunication system using said received reference symbol by correlating said plurality of repetition patterns within a correlation window having a predetermined length and by detecting a correlation peak which indicates the position of said last repetition pattern using the phase-shift information of said last repetition pattern in relation to the other repetition patterns in said reference symbol.

Claim 61. (new) The method according to claim 60, wherein said phase shifted repetition pattern is phase-shifted by 180° in relation to said other repetition patterns.

Claim 62. (new) The method according to claim 60, wherein said correlation window length corresponds to the length of one repetition pattern, and a detecting step for detecting the correlation peak is performed after the correlation step.

Claim 63. (new) The method according to claim 62, wherein said detecting step comprises the steps of delaying the output signal of said correlation step by one repetition pattern

length, and subtracting the output signal of said delay step from the output signal of said correlation step.

Claim 64. (new) The method according to claim 63, further comprising the step of smoothing the output signal of said detection step.

Claim 65. (new) The method according to claim 60, wherein said correlation window length corresponds to the length of two repetition patterns for detecting the position of the correlation peak.

Claim 66. (new) The method according to claim 65, wherein said correlation step uses a positive and a negative conjugation of an expected repetition pattern for detecting the position of said correlation peak.

Claim 67. (new) The method according to claim 60, further comprising the steps of peak threshold detection and gap detection after said detection step is performed, whereby said correlation peak detected in said detection step is confirmed or not on the basis of the detection results of said peak threshold detection and said gap detection.

Claim 68. (new) The method according to claim 67, wherein said peak threshold detection step detects if the output signal of said detection step exceeds a predetermined correlation peak threshold and said gap detection step detects if the output signal of said

detection step has been below a predetermined gap threshold before said detected correlation peak.

Claim 69. (new) The method according to claim 68, further comprising the step of delaying the output signal of said detection step before said gap detection is performed.

Claim 70. (new) The method according to claim 68, wherein the step of gap detection detects if the output signal of said detection step has been below said predetermined gap threshold during a predetermined gap time.

Claim 71. (new) A receiving apparatus for receiving signals in a OFDM telecommunication system, comprising:

receiving means for receiving a reference symbol comprising a plurality of successive repetition patterns, wherein each of said repetition patterns comprises a number of samples, the number of samples being the same for each repetition pattern, and whereby a last repetition pattern of said repetition patterns is phase-shifted in relation to the other repetition patterns, and

synchronizing means for performing a time and frequency synchronization of the receiving apparatus in the OFDM telecommunication system using said received reference symbol, said synchronizing means comprising correlation means for cross correlating the plurality of repetition patterns within a correlation window having a predetermined length, and said synchronizing means including detection means that uses the phase-shift information of said last repetition pattern in relation to the other repetition

patterns in said reference symbol to detect a correlation peak which indicates the position of said last repetition pattern.

Claim 72. (new) A method for synchronizing a receiving apparatus in a OFDM telecommunication system, comprising the steps of:

receiving a reference symbol comprising a plurality of successive repetition patterns, wherein each of said repetition patterns comprises a number of samples, the number of samples being the same for each repetition pattern, and whereby a last repetition pattern of said repetition patterns is phase-shifted in relation to the other repetition patterns, and

synchronizing the receiving apparatus in time and frequency in the OFDM telecommunication system using said received reference symbol by cross correlating the plurality of repetition patterns within a correlation window having a predetermined length and by detecting a correlation peak which indicates the position of said last repetition pattern using the phase-shift information of said last repetition pattern in relation to the other repetition patterns in said reference symbol.

Claim 73. (new) A receiving device for receiving OFDM signals transmitted from a transmitter device in an OFDM system, comprising:

receiving means for receiving a reference symbol comprising a sequence of a plurality of repetition patterns, wherein said reference symbol is transmitted from said transmitter device by using multicarrier of said OFDM system and a last repetition

pattern of said sequence of plurality of repetition patterns is phase-shifted in relation to the other repetition patterns, and

synchronizing means for synchronizing the receiving apparatus in the OFDM system by cross-correlating said successive repetition patterns to perform a time domain synchronization and for detecting a frequency offset between said transmitter device and said receiver device in said OFDM system to perform a frequency synchronization by using said successive reference symbols including said phase-shifted repetition pattern.

Claim 74. (new) A method for synchronizing a receiving apparatus to OFDM signals transmitted from a transmitter device in an OFDM system, comprising the steps of receiving a reference symbol comprising a sequence of a plurality of repetition patterns, wherein said reference symbol is transmitted from said transmitter device by using multicarrier of said OFDM system and a last repetition pattern of said sequence of plurality of repetition patterns is phase-shifted in relation to the other repetition patterns, and

synchronizing the receiving apparatus in the OFDM system by cross-correlating said successive repetition patterns to perform a time domain synchronization and for detecting a frequency offset between said transmitter device and said receiver device in said OFDM system to perform a frequency synchronization by using said successive reference symbols including said phase-shifted repetition pattern.

Claim 75. (new) A receiving device for receiving OFDM signals transmitted from a transmitter device in an OFDM system, comprising:

receiving means for receiving a reference symbol comprising a sequence of a plurality of repetition patterns, wherein said reference symbol is transmitted from said transmitter device by using multicarrier of said OFDM system and a last repetition pattern of said sequence of plurality of repetition patterns is phase-shifted in relation to the other repetition patterns, and

synchronizing means for synchronizing the receiving apparatus in the OFDM system by cross-correlating said successive repetition patterns to perform a time domain synchronization and for detecting a frequency offset between said transmitter device and said receiver device in said OFDM system based on a phase change information introduced by said reference symbol to perform a frequency synchronization.

Claim 76. (new) A method for synchronizing a receiving apparatus to OFDM signals transmitted from a transmitter device in an OFDM system, comprising the steps of:

receiving a reference symbol comprising a sequence of a plurality of repetition patterns, wherein said reference symbol is transmitted from said transmitter device by using multicarrier of said OFDM system and a last repetition pattern of said sequence of plurality of repetition patterns is phase-shifted in relation to the other repetition patterns, and

synchronizing the receiving apparatus in the OFDM system by cross-correlating said successive repetition patterns to perform a time domain synchronization and for detecting a frequency offset between said transmitter device and said receiver device in said OFDM system based on a phase change information introduced by said reference symbol to perform a frequency synchronization.